

CLAIMS

WHAT IS CLAIMED IS:

1. A method of sending first and second data from a first computing device to a second computing device remote from the first computing device, the first and second computing devices being communicatively connected by a network, the
5 method comprising:

at said first computing device, creating a first packet which includes the first data and a first flag which indicates that said first packet is to be sent reliably;

10 at said first computing device, creating a second packet which includes the second data and a second flag which indicates that said second packet is to be sent non-reliably;

sending said first packet from the first computing device to the second computing device using the network;

15 determining that a first number of packets that have been sent from the first computing device to the second computing and for which acknowledgement has not been received by the first computing device does not exceed a second number; and

20 sending said second packet from the first computing device to the second computing device using the network.

2. The method of claim 1, wherein said first packet comprises (a) a first header which includes said first flag, and (b) a body which includes the first data, and wherein said second packet comprises (a) a second header which includes said second
25 flag, and (b) a body which includes the second data.

3. The method of claim 1, further comprising:

initializing a sequence number counter; and

incrementing said sequence number counter upon creation of a packet;

wherein said acts of creating said first and second packets each comprise including a current value of said sequence number counter in the respective created packets.

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4. The method of claim 1, further comprising:

receiving, at the first computing device, an acknowledgment that said first and second packets have been received by the second computing device.

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5. The method of claim 1, further comprising:

at the first computing device, receiving data which indicates that said first packet was not received;

determining that said first packet was sent reliably; and

re-sending said first packet from the first computing device to the second computing device.

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6. The method of claim 1, wherein said first packet includes a first sequence number, wherein said act of receiving data which indicates that said first packet was not received includes:

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receiving a second sequence number and a mask, said mask having a plurality of bits, each of said bits having an offset from a reference position in said mask, a first of said bits having a value of one, said first of said bits having a first offset from said reference position which corresponds to a second offset of said first sequence number from said second sequence number.

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7. The method of claim 1, further comprising:

at the first computing device, receiving data which indicates that said second packet was not received;

determining that said second packet was sent non-reliably; and
sending, from the first computing device to the second computing
device, a message which indicates that said second packet will not be re-sent.

5 8. The method of claim 1, wherein said second packet includes a first
sequence number, wherein said act of receiving data which indicates that said second
packet was not received includes:

receiving a second sequence number and a mask, said mask
having a plurality of bits, each of said bits having an offset from a reference position in
10 said mask, a first of said bits having a value of one, said first of said bits having a first
offset from said reference position which corresponds to a second offset of said first
sequence number from said second sequence number.

9. A computer-readable medium having computer-executable instructions
15 to perform a method of sending first and second data from a first computing device to a
second computing device remote from the first computing device, the first and second
computing devices being communicatively connected by a network, the method
comprising:

at said first computing device, creating a first packet which
20 includes the first data and a first flag which indicates that said first packet is to be sent
reliably;

at said first computing device, creating a second packet which
includes the second data and a second flag which indicates that said second packet is to
be sent non-reliably;

25 sending said first packet from the first computing device to the
second computing device using the network;

determining that a first number of packets that have been sent
from the first computing device to the second computing and for which

acknowledgement has not been received by the first computing device does not exceed a second number; and

sending said second packet from the first computing device to the second computing device using the network.

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10. A computer-readable medium having stored thereon a first data packet transmittable to a computing device, the first data packet comprising:

a first byte which includes:

10 a reliability bit which indicates whether the first data packet is to be transmitted reliably; and

a sequence bit which indicates whether the order in which the first data packet is transmitted relative to a second data packet is to be preserved;

a second byte which indicates the presence of one or more masks in the first data packet; and

15 an eight-bit sequence number.

11. The computer-readable medium of claim 10, wherein said data structure is creatable by a protocol engine which exposes an interface callable by a software application, and wherein said first byte further includes:

20 a type bit which indicates whether the first data packet is of a first type or a second type different from the first type;

a poll bit which indicates whether an immediate acknowledgement of the first data packet is requested upon receipt by the computing device;

25 a new message bit which indicates whether the first data packet is an initial component of a message;

an end message bit which indicates whether the first data packet is a final component of a message; and

two bits assignable by the software application.

12. The computer-readable medium of claim 10, wherein said second byte includes:

5 a set of mask bits, each of said mask bits corresponding to one of said one or more masks, each mask bit indicating whether the corresponding mask is present in the first data packet.

13. The computer-readable medium of claim 12, the first data packet
10 further comprising:

 a mask which corresponds to a first of said mask bits;
wherein said first of said mask bits is equal to one.

14. The computer-readable medium of claim 10, the first data packet
15 further comprising:

 an eight-bit number which is equal to the sequence number of the next packet expected to be received by a creator of said first data packet.

15. The computer-readable medium of claim 10, wherein said data
20 structure is creatable by a protocol engine which exposes an interface callable by a software application, the first data packet further comprising:

 data generated by the software application.

16. The computer-readable medium of claim 15, wherein said first data
25 packet includes at least one of said one or more masks.

17. A method of participating in communications with a first computing device, the method comprising the acts of:

at a second computing device remote from the first computing device, receiving a plurality of first packets, each of said packets including a sequence number;

5 at said second computing device, determining, based on the respective sequence numbers of said plurality of first packets, that a second packet sent by the first computing device has not been received by the second computing device;

at said second computing device, sending to the first computing device an indication that said second packet has not been received, said indication comprising:

10 a reference number which is higher than or equal to a sequence number of said second packet; and

a mask having a plurality of bits which indicates, relative to said reference number, a sequence number of said second packet.

15 18. The method of claim 17, wherein each of said bits is located at an n -th offset into said mask, a lowest-order bit in the mask having a zero-th offset, and wherein the m -th bit in said mask is equal to one, m being equal to the sequence number of said second packet minus said reference number minus one.

20 19. The method of claim 17, wherein said reference number comprises an eight-bit number.

20. The method of claim 17, wherein said mask comprises a 32-bit data element.

25 21. The method of claim 17, wherein said indication further comprises a second mask having a plurality of bits which indicates, relative to said reference number, packets having sequence numbers more than a first number greater than said

reference number, and wherein the sequence number of said second packet is greater than said first number.

22. A computer-readable medium having computer-executable
5 instructions to perform a method of participating in communications with a first computing device, the method comprising the acts of:

at a second computing device remote from the first computing device, receiving a plurality of first packets, each of said packets including a sequence number;

10 at said second computing device, determining, based on the respective sequence numbers of said plurality of first packets, that a second packet sent by the first computing device has not been received by the second computing device;

at said second computing device, sending to the first computing device an indication that said second packet has not been received, said indication
15 comprising:

a reference number which is higher than or equal to a sequence number of said second packet; and

a mask having a plurality of bits which indicates, relative to said reference number, a sequence number of said second packet.

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23. A method of communicating with a computing device comprising:

sending to the computing device a first packet which includes: (a) first data, and (b) an indication that said first packet is to be sent reliably;

sending to the computing device a second packet which includes:
25 (a) second data, and (b) an indication that said second packet is to be sent non-reliably;

receiving from the computing device an indication that said first and second packets have not been received by the computing device;

re-sending said first packet to the computing device; and

sending to the computing device an indication that said second packet will not be re-sent.

24. The method of claim 23, wherein said first packet comprises a header which includes a command byte having a plurality of bits, a first of said plurality of bits comprising the indication that said first packet is to be sent reliably.

25. The method of claim 23, wherein said second packet has a sequence number associated therewith, and wherein said act of sending an indication that said second packet will not be re-sent comprises:

creating a third packet which includes:

a reference number;

a control byte having a plurality of bits, one or more of said plurality of bits indicating the presence in said third packet of one or more masks;

a mask having a plurality of bits, each of said bits corresponding to a packet sequence number relative to said reference number, the bit corresponding to the sequence number of said second packet indicating that said second packet will not be re-sent.

26. A computer-readable medium having computer-executable instructions to perform a method of communicating with a computing device, the method comprising:

sending to the computing device a first packet which includes: (a) first data, and (b) an indication that said first packet is to be sent reliably;

sending to the computing device a second packet which includes: (a) second data, and (b) an indication that said second packet is to be sent non-reliably;

receiving from the computing device an indication that said first and second packets have not been received by the computing device;

re-sending said first packet to the computing device; and
sending to the computing device an indication that said second
packet will not be re-sent.

5 27. A device for communicating data in a computer network which
connects the device to one or more remote devices, the device comprising:

a processor which executes computer-executable instructions;

a memory communicatively coupled to said processor, said
memory storing:

10 first logic executable on said processor which receives (a)
first data, (b) an indication of whether said first data is to be transmitted reliably or
non-reliably, and (c) an identifier of a first one of the remote devices to which said first
data is to be sent;

a sequence counter;

15 second logic executable on said processor which creates a
package including (a) said first data, (b) second data indicative of said indication, and
(c) a current value of said sequence counter, and which increments said sequence
counter upon creation of said package;

20 a network interface which communicates said package to said first
one of the remote devices over the computer network and which receives from said first
one of the remote devices a selective acknowledgment indicative of whether said first
package has been received by said first one of the remote devices, said network
interface being communicatively coupled to said memory and to the computer network;

said memory further storing:

25 third logic executable on said processor which creates a
response that includes either (a) said first packet, or (b) a message that said first packet
will not be re-sent, according to whether indication indicates reliable or non-reliable
transmission of said first data.

28. The device of claim 27, wherein said message that said first packet will not be re-sent comprises:

a reference number;

5 a mask having a plurality of bits, each of said bits corresponding to a sequence counter value relative to said reference number, wherein a one of said bits that corresponds to the sequence counter value of said first packet has a bit value which indicates that said first packet will not be re-sent.

10 29. The device of claim 27, wherein said selective acknowledgment comprises:

a reference number;

15 a mask having a plurality of bits, each of said bits corresponding to a sequence counter value relative to said reference number, wherein a one of said bits that corresponds to the sequence counter value of said first packet has a bit value which indicates whether said first packet has been received by said first one of the remote devices.